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Chapter
5

Solving Systems of Linear Equations

Dear Family,

Has your family ever considered starting a business on the side to supplement your income? Your family could deliver papers, sell crafts, or sell items on a website, to name a few options. The goal of starting a business is to make a *profit*, or to have more income than expenses.

The *break-even point* is where the income equals the expenses. Making a graph is a good way to keep track of income and expenses. The break-even point is where the income line intersects the expense line.

Suppose your family decides to start a small business. Research some of the options in your area. Now it is time to come up with a small business plan. Listed below are a few basic steps to get your business started.

- Decide what supplies you will need to start your business. How much money will you need to invest in these supplies to start your business? This amount will represent your *initial investment*. Plot this point on your graph.
- Now figure out how much it will cost to produce the items you plan to sell. This is the *unit cost*. Use this to plot more points on the graph to make an expense line.
- Finally determine how much you will sell the item for. This is known as the *unit price*. Starting at the origin of your graph, use the unit price to make an income line.
- Now look at your graph. Do the two lines cross? This is the break-even point, or the number of items you need to sell to cover your expenses.

If your lines do not cross, what might be the cause? Consider changing the unit price. Can you set the unit price to be whatever you like? Discuss your reasoning. Consider your competitors. Discuss ways you can make your product more attractive to the buyers without necessarily lowering (or raising) the price.

What effect does changing your initial investment have on your break-even point? What effect does changing the unit cost have on the break-even point? Which one do you believe has the greater effect over time?

Capítulo

5

Resolver sistemas de ecuaciones lineales

Estimada familia:

¿Su familia alguna vez ha considerado comenzar un negocio paralelo para complementar sus ingresos? Su familia podría repartir periódicos, vender artesanías, o vender objetos en un sitio web, solo por nombrar algunas opciones. El objetivo de comenzar un negocio es tener una *ganancia*, o tener más ingresos que gastos.

El *punto de equilibrio* es donde los ingresos igualan a los gastos. Hacer una gráfica es una buena manera de llevar un registro de los ingresos y gastos. El punto de equilibrio es donde la recta de los ingresos se interseca con la recta de los gastos.

Supongan que su familia decide comenzar una pequeña empresa. Investiguen algunas opciones en su área. Ahora es el momento de idear un plan para pequeñas empresas. A continuación, se enumeran unos pocos pasos básicos para comenzar su negocio.

- Decidan qué suministros necesitarán para comenzar su negocio. ¿Cuánto dinero necesitarán invertir en estos suministros para comenzar su negocio? Esta cantidad representará su *inversión inicial*. Marquen este punto en su gráfica.
- Ahora calculen cuánto costará producir los objetos que planean vender. Este es el *costo unitario*. Usen esto para marcar más puntos en la gráfica para hacer una recta de gastos.
- Finalmente, determinen a cuánto venderán cada objeto. Esto se conoce como el *precio unitario*. Comenzando desde el origen en su gráfica, usen el precio unitario para hacer una recta de ingresos.
- Ahora observen la gráfica. ¿Se cruzan las dos rectas? Este es el punto de equilibrio o el número de objetos que necesitan vender para cubrir sus gastos.

Si sus rectas no se intersecan, ¿cuál podría ser la causa? Consideren cambiar el precio unitario. ¿Pueden fijar el precio unitario en cualquier monto que quieran? Comenten su razonamiento. Consideren a la competencia. Comenten maneras de hacer que su producto sea más atractivo a los compradores sin necesariamente bajar (o subir) el precio.

¿Qué efecto tiene cambiar su inversión inicial en su punto de equilibrio? ¿Qué efecto tiene cambiar el costo unitario en el punto de equilibrio? ¿Cuál creen que tiene mayor efecto con el transcurso del tiempo?

5.1 Start Thinking

Graph the linear equations $y = -x + 7$ and $y = \frac{2}{3}x + \frac{11}{3}$ on a coordinate plane. The two lines intersect at the point $(2, 5)$.

What does the point of intersection of two linear equations represent? Substitute the values into each equation. Is the point a solution to each equation? Are there any other points that will satisfy both equations? Why or why not?

5.1 Warm Up

Tell whether the ordered pair is a solution to the equation.

1. $(4, 4); y = -x + 8$

2. $(-2, 3); y = -2x - 1$

3. $(3, 2); x + 6y = 13$

4. $(1, 3); 4x - 3y = -5$

5. $(-1, -2); y = 3x$

6. $(-3, 9); y = -3x$

7. $(0, -1); y = 4x - 1$

8. $(-2, 8); y = -2x - 1$

5.1 Cumulative Review Warm Up

Write an equation in point-slope form of the line that passes through the given point and has the given slope.

1. $(1, 2); m = 1$

2. $(8, -5); m = -5$

3. $(8, 1); m = -4$

4. $(-5, 5); m = 4$

5. $(4, 0); m = 5$

6. $(-5, 3); m = 1$

7. $(8, 1); m = \frac{2}{3}$

8. $(7, -2); m = -\frac{4}{5}$

5.1 Practice A

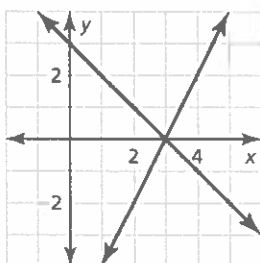
In Exercises 1 and 2, tell whether the ordered pair is a solution of the system of linear equations.

1. $(3, 4)$; $x + y = 7$
 $x - 2y = -5$

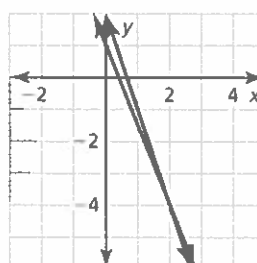
2. $(-5, 2)$; $y = -x - 3$
 $y = 3x + 10$

In Exercises 3 and 4, use the graph to solve the system of linear equations. Check your solution.

3. $x + y = 3$
 $2x - y = 6$



4. $5x + 2y = 2$
 $3x + y = 2$



In Exercises 5 and 6, solve the system of linear equations by graphing.

5. $y = x + 4$
 $y = -x + 8$

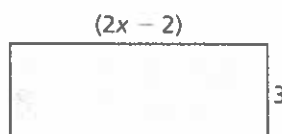
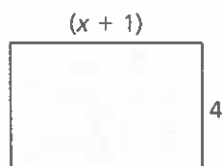
6. $y = \frac{1}{3}x + 6$
 $y = -\frac{2}{3}x + 3$

In Exercises 7 and 8, use a graphing calculator to solve the system of linear equations.

7. $0.2x - 0.2y = 2$
 $0.9x + 0.6y = 6$

8. $-1.5x + y = 2.5$
 $15x - 1.5y = 4.8$

9. You sell bracelets for \$2 each and necklaces for \$3 each at a local flea market. You collect \$95, selling a total of 37 jewelry items. How many of each type of jewelry did you sell?
10. For each rectangle below, write a linear equation that represents the area y of the rectangle. Solve this system of two linear equations by graphing. Interpret your solution.

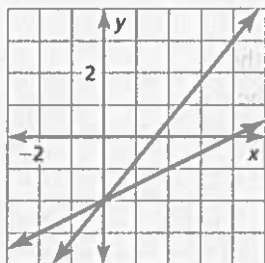


5.1 Practice B

In Exercises 1 and 2, use the graph to solve the system of linear equations. Check your solution.

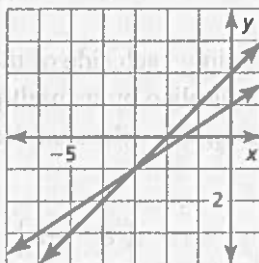
1. $5x - 4y = 8$

$-x + 2y = -4$



2. $4x - 6y = -6$

$4x - 4y = -8$



In Exercises 3–6, solve the system of linear equations by graphing.

3. $3x - 5y = 2$

$y = 2$

4. $-x + 4y = -10$

$2x - 3y = 5$

5. $y = -\frac{3}{2}x - 3$

$y = \frac{1}{2}x + 5$

6. $3x + 3y = -3$

$5x + 2y = 1$

In Exercises 7 and 8, use a graphing calculator to solve the system of linear equations.

7. $0.8x - 0.9y = 0$

$x - 0.5y = 1$

8. $4.2x - y = 3$

$2x - y = -0.3$

9. You spend \$11 on school supplies. You purchase pencils for \$0.25 each and pens for \$2 each. You purchase a total of 30 pencils and pens. How many of each did you purchase?
10. You begin with \$90 in your savings account and your friend begins with \$35 in her savings account. You deposit \$10 in savings each week, and your friend deposits \$15 in savings each week.
- Write and graph a system of linear equations that represent the amounts in each of your savings accounts.
 - Your friend says that in 10 weeks you will both have the same amount of money in your savings accounts. Is your friend correct? Use the graph from part (a) to explain your answer.

5.1 Enrichment and Extension

Solving Systems Using Matrices

Example: Solve the system of equations by using matrices. Check your solution.

$$\begin{array}{l} -x + 4y = -4 \\ -x + y = 2 \end{array} \quad \text{Set up a matrix equation: } \begin{bmatrix} -1 & 4 \\ -1 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -4 \\ 2 \end{bmatrix}$$

To solve a matrix equation, multiply each side of the equation by the inverse of the coefficient matrix. Anything multiplied by its multiplicative inverse will equal the multiplicative identity, eliminating the values on the left side of the equation, and solving for x and y .

$$\text{If } A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, \text{ then } A^{-1} = \frac{1}{ad - bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}. \quad A^{-1} \text{ is the inverse of } A.$$

$$\frac{1}{3} \begin{bmatrix} 1 & -4 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} -1 & 4 \\ -1 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{3} \begin{bmatrix} 1 & -4 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} -4 \\ 2 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{3} \begin{bmatrix} -12 \\ -6 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -4 \\ -2 \end{bmatrix} \rightarrow (-4, -2) \text{ is the solution to the system of equations.}$$

In Exercises 1–4, solve the system of equations by using matrices. Check your solution.

1. $-10x - 6y = 8$

$$6x - 3y = 15$$

2. $x - 4y = 11$

$$5x - 7y = -10$$

3. $-4x + 5y = -19$

$$-x - 2y = 5$$

4. $7x - y = -1$

$$-3y = -3 + 6x$$

5. The sum of two numbers is 5. One of the numbers is 9 less than the other number. What are the two numbers?

5.1 Puzzle Time

What Asks No Questions But Must Be Answered?

Write the letter of each answer in the box containing the exercise number.

Tell whether the ordered pair is a solution of the system of linear equations.

1. $(-1, 6)$; $6x + 3y = 18$
 $2x + y = 7$

2. $(12, 0)$; $2x + 6y = 24$
 $\frac{1}{2}x + 3y = 6$

3. $(5, -8)$; $9x + 7y = -11$
 $-2x - 5y = 30$

4. $(16, 1)$; $y = -\frac{1}{4}x + 5$
 $y = \frac{1}{6}x - 2$

Solve the system of linear equations by graphing.

5. $y = x + 1$
 $y = -x - 1$

6. $y = -2x - 4$
 $y = 3x + 1$

7. $y = -\frac{2}{3}x + 2$
 $y = \frac{1}{3}x + 5$

8. $4x - y = 2$
 $x - y = -1$

9. $x + y = -5$
 $-x + 2y = 5$

10. $x + 2y = 12$
 $x - 2y = -12$

11. The perimeter of your closet is equal to 18 feet. The difference of the length and the width equals 1 foot. Write a system of linear equations which represent the perimeter of your closet in respect to its width (x -axis) and length (y -axis), and solve the system by graphing.

Answers

E. yes

L. no

O. $(-5, 0)$

R. $(-3, 4)$

D. $(4, 5)$

H. $(-1, 0)$

B. $(0, 6)$

T. $(1, 2)$

O. $(-1, -2)$

8	5	3		11	6	9	7	10	2	4	1
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5.2 Start Thinking

A store owner purchased 30 incandescent light bulbs and 20 compact fluorescent lamps (CFLs) for a total cost of \$40.30. A second purchase at the same prices included 20 incandescent bulbs and 30 CFLs for a total cost of \$43.20.

Define variables and write separate equations for each of the store owner's purchases. What would the equations look like if you solved each of them for the variable representing the cost of one CFL?

5.2 Warm Up

Solve. Check your solution.

1. $4x = 12$

2. $3 = 5x - 7$

3. $6 + 2w = -2$

4. $5a + 19 = -1$

5. $x - 4 = -6$

6. $1 = 9 + 4a$

5.2 Cumulative Review Warm Up

Write and solve an equation to answer the question.

1. The temperature at 6 A.M. was 19°F . The temperature at 2 P.M. was 25°F . How many degrees did the temperature rise?
2. The length of a garden is 2 times its width. If the length of the garden is 10.4 feet, what is its width?
3. The remaining amount in an account is \$499 more than the balance was 3 years ago. The current balance of the account is \$5697. What was the balance 3 years ago?

5.2 Practice A

In Exercises 1–3, tell which equation you would choose to solve for one of the variables. Explain.

1. $5x + y = 2$ 2. $2x - 3y = 6$ 3. $4x - y = -3$
 $3x + y = 7$ $x + 7y = 2$ $3x + 3y = 7$

In Exercises 4–9, solve the system of linear equations by substitution. Check your solution.

4. $y = 10 - 2x$ 5. $4y + 1 = x$ 6. $y = 11 + 4x$
 $x = y - 4$ $x = 5y$ $3x + 2y = 0$
7. $5y = 10$ 8. $x + y = -2$ 9. $-x + y = 2$
 $x - 3y = 4$ $2x - y = 14$ $3x - 5y = -4$

10. Describe and correct the error in solving for one of the variables in the linear system $-x + 4y = -9$ and $3x - 2y = 7$.

X	Step 1	$-x + 4y = -9$
		$-x = -4y - 9$
	Step 2	$3(-4y - 9) - 2y = 7$
		$-12y - 27 - 2y = 7$
		$-14y = 34$
		$y = -\frac{17}{7}$

In Exercises 11–13, write a system of linear equations that has the ordered pair as its solution.

11. $(1, 4)$ 12. $(9, -3)$ 13. $(-2, -1)$

14. A biology test is worth 100 points and has 36 questions.

- a. Multiple-choice questions are worth 2 points each and essay questions are worth 6 points each. How many questions of each type are on the test?
- b. Your friend says that it is possible for the multiple-choice questions to be worth 4 points each. Is your friend correct? Explain.

15. Find the values of a and b so that the solution of the linear system is $(5, 2)$.

$ax + by = 23$ Equation 1

$ax - by = 7$ Equation 2

5.2 Practice B

In Exercises 1–6, solve the system of linear equations by substitution. Check your solution.

1. $2x + 2y = 4$
 $y = 12 - 3x$
2. $-2x + 9y = 15$
 $x + 7 = 4$
3. $x - y = 4$
 $2x - 3y = 3$
4. $4x + 3y = -1$
 $3x + y = -7$
5. $5x + 5y = -10$
 $3x - 7y = 4$
6. $-x + y = 7$
 $6x - y = -7$

7. A humane society has 73 dogs and cats to be adopted. The number of cats is 10 more than twice the number of dogs. Write a system of linear equations that represents this situation. How many of each animal is up for adoption?

In Exercises 8–10, write a system of linear equations that has the ordered pair as its solution.

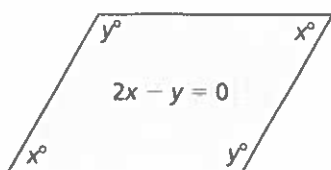
8. $(-6, -2)$
9. $(-12, 18)$
10. $(2, 0)$

11. A wedding planner purchased both small and large lanterns for a wedding reception. The planner purchased a total of 40 lanterns for a purchase price of \$1180. How many of each size lantern did the planner purchase?

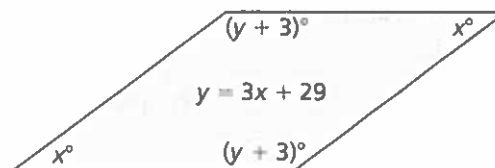
Lantern	Small	Large
Price	\$25	\$40

In Exercises 12 and 13, (a) write an equation that represents the sum of the angle measures of the parallelogram and (b) use your equation and the equation shown to find the values of x and y .

12.



13.



14. Write a system of linear equations in which $(2, -1)$ is a solution of Equation 1 but not a solution of Equation 2, and $(5, 5)$ is a solution of the system.

5.2 Enrichment and Extension

Systems of Three Equations

Example: Solve the system of equations. Check your solution.

Equation 1: $4r + 4s + 3t = 13$

Equation 2: $r + s - 5t = -14$

Equation 3: $-r + 3s - t = -24$

Add Equation 2 and Equation 3.

$$r + s - 5t = -14$$

$$-r + 3s - t = -24$$

$$4s - 6t = -38$$

$$2s - 3t = -19 \quad \text{New Equation 2}$$

Add Equation 1 and 4 times Equation 3.

$$4r + 4s + 3t = 13$$

$$4(-r + 3s - t = -24)$$

$$4r + 4s + 3t = 13$$

$$-4r + 12s - 4t = -96$$

$$16s - t = -83 \quad \text{New Equation 1}$$

Add New Equation 2 and
-3 times New Equation 1.

$$2s - 3t = -19$$

$$-3(16s - t = -83)$$

$$2s - 3t = -19$$

$$-48s + 3t = 249$$

$$-46s = 230$$

$$s = -5$$

Substitute $s = -5$
into New Equation 2.

$$2s - 3t = -19$$

$$2(-5) - 3t = -19$$

$$-10 - 3t = -19$$

$$-3t = -9$$

$$t = 3$$

Substitute $s = -5$ and $t = 3$
into Equation 2.

$$r + s - 5t = -14$$

$$r + (-5) - 5(3) = -14$$

$$r - 20 = -14$$

$$r = 6$$

So, the solution of the system of equations is $(6, -5, 3)$.

In Exercises 1-4, solve the system of equations. Check your solution.

1. $6x + 3y + 2z = 23$

$$-3x - y = -5$$

$$2x + 3y + z = 19$$

2. $-5x - 3y + z = -4$

$$-2x - 2y + 2z = 4$$

$$x = z - 5$$

3. $3x + 5y + 4z = 18$

$$6x + y + 3z = 21$$

$$-6x - 4z = -24$$

4. $2x + y - 3z = 9$

$$-2x + 4y - 2z = 16$$

$$x + 3y - 2z = 11$$

5. The sum of three numbers is -3. The last number is three times the first. The last number is 11 smaller than the second number. What are the three numbers?



Puzzle Time

Did You Hear About The Pig That Built Himself A Home?

A	B	C	D	E	F
G	H	I	J	K	L
M					

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

(-5, -4) IN
(0, 0) BRICK
(6, 0) CALLED
(0, -2) MADE
(1, 3) TAIL
(-3, -3) IT
(-4, -8) KNOT
(8, 8) THREE
(7, 2) WOOD

**Solve the system of linear equations by substitution.
Check your solution.**

A. $3x + 2y = 12$

$y = x - 9$

C. $-3x + 5y = 5$

$y = x - 1$

E. $7x = -35$

$-8x + 9y = 4$

G. $13x - 6y = -5$

$x + 10 = 11$

I. $x = 6 + 2y$

$-3x + 14y = -18$

K. $x - y = -8$

$6x + y = -6$

B. $4x + y = -2$

$y = 2x - 2$

D. $2x + y = -16$

$y = 2x$

F. $-4x + 3y = 20$

$-14y = -56$

H. $9x - 2y = 12$

$y + 4 = 16$

J. $5x - 9y = 12$

$x + y = -6$

L. $7x - 3y = 17$

$2x - y = 6$

- M.** The physical education instructor asked each student to do a total of 36 pull-ups and push-ups in 1 minute. The instructor wanted students to do 8 times as many push-ups as pull-ups. Write a system of linear equations that represents this situation. How many pull-ups and push-ups were required in 1 minute?

(5, 4) A
(4, 12) AND
(4, 32) TIE
(6, -3) HE
(-2, 6) A
(-2, 4) HIS
(-1, -8) PIG'S
(12, 0) NAILS
(0, 15) YARD

5.3 Start Thinking

Consider the system of linear equations:

$$3x - 2y = 7$$

$$5x - 2y = 13$$

Are the coefficients of either the x -values or the y -values the same?

If so, what are they? Subtract the second equation from the first equation to eliminate the like terms. What is the resulting equation?

Why is this method of solving systems of linear equations useful?

Solve the resulting equation. How can you solve the system of linear equations from this point? What is the solution?

5.3 Warm Up

Simplify.

1. $7x - 7x$

2. $5y - (-11y)$

3. $-11a - 16a$

4. $-11xy - 18xy$

5. $-\frac{1}{3}x + \frac{1}{2}x$

6. $2x - 6x - 2x$

5.3 Cumulative Review Warm Up

Write the sentence as an absolute value inequality.

Then solve the inequality.

1. A number is greater than 5 units from 1.
2. A number is less than 8 units from 4.
3. Half a number is at least 4 units from 15.
4. Triple a number is no more than 9 units from 0.

5.3 Practice A

In Exercises 1–6, solve the system of linear equations by elimination. Check your solution.

1. $x - 3y = 2$
 $-x + 2y = -3$

2. $4x - y = 5$
 $3x + y = 9$

3. $2x - 5y = -7$
 $-2x + 3y = 1$

4. $-x + y = 9$
 $x + 2y = 6$

5. $2x - 3y = 9$
 $5x + 3y = 12$

6. $-4x - y = 11$
 $4x + 4y = -20$

In Exercises 7–12, solve the system of linear equations by elimination. Check your solution.

7. $x + y = 7$
 $5x + 2y = 8$

8. $7x - 6y = 9$
 $5x + 2y = 19$

9. $2x - 7y = 5$
 $x - y = 10$

10. $3x + 4y = -1$
 $-2x - 5y = 10$

11. $-5x + 12y = 8$
 $2x - 8y = 0$

12. $-10x + 3y = -30$
 $15x - 8y = 45$

13. You and your friend are buying throw blankets with your names embroidered on them. The cost of the throw blanket is x dollars and the cost of each embroidered letter is y dollars. Your name has 6 letters and the total cost is \$29. Your friend's name has 3 letters and the total cost is \$24.50. Find the cost of the throw blanket and the cost of each embroidered letter.

In Exercises 14–16, solve the system of linear equations using any method. Explain why you chose the method.

14. $2x - 5y = 1$
 $2x = 9 - 3y$

15. $4x - 6 = -2y$
 $x + 9 = y$

16. $6x + 5y = 14$
 $3x + 10y = -8$

17. You are ordering T-shirts for the Spanish Club. The table shows the orders for 45 students in the club.

Small	Medium	Large
11	x	y

- How many students ordered medium and large shirts?
- The number of students who ordered a medium T-shirt was two less than the number of students who ordered a large T-shirt. Write a system of linear equations that represents the number of students who ordered medium and large T-shirts.
- Solve the system of linear equations.
- You are ordering 10 additional medium and large T-shirts for new members who might join the club. Based on your answers in part (c), how many of each size would you order? Explain.

5.3 Practice B

In Exercises 1–6, solve the system of linear equations by elimination. Check your solution.

1. $2x + y = 10$

$5x - y = 11$

2. $-3x + 2y = 14$

$4x - 2y = -16$

3. $x + 2y = 7$

$13 - 5y = x$

4. $10x - 11 = -3y$

$5y - 5 = -10x$

5. $2y - 4 = 3x$

$2x - 6 = 2y$

6. $8x + 3y = -5$

$3y = x + 4$

In Exercises 7–12, solve the system of linear equations by elimination. Check your solution.

7. $3x - 4y = 19$

$6x + 9y = 21$

8. $4x + 5y = 3$

$-3x + 2y = 38$

9. $8x + 2y = 22$

$5x - 3y = 35$

10. $4x + 7y = 1$

$6x - 3y = 15$

11. $21x - 11y = -9$

$-14x + 8y = 4$

12. $3x + 6y = 6$

$-2x - 9y = -24$

13. Describe and correct the error in solving for one of the variables in the linear system $4x + 5y = -10$ and $2x - 4y = 9$.

✗

Step 1 $4x + 5y = -10$

$2x - 4y = 9$

Step 2 (Multiply by 2.)

$4x + 5y = -10$

$4x - 8y = 18$

Step 3 $-3y = 8$

$y = -\frac{8}{3}$

In Exercises 14–16, solve the system of linear equations using any method. Explain why you chose the method.

14. $x - y = 3$

$x = \frac{1}{3}y + 5$

15. $x + 2y = \frac{5}{2}$

$3x - 5y = 2$

16. $4x - 5y = -3$

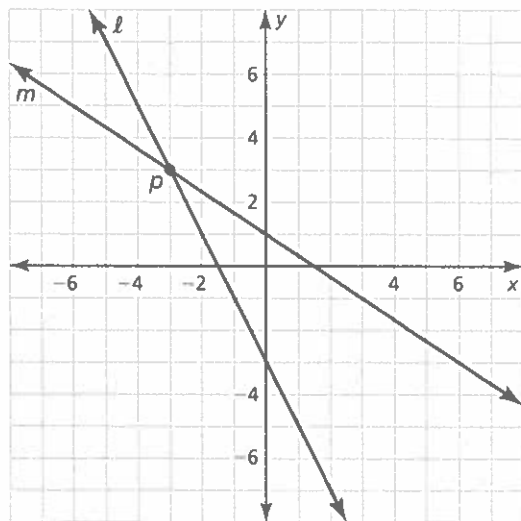
$14x + 2y = 9$

17. You and your friend are making 30 liters of sodium water. You have liters of 10% sodium and your friend has liters of 22% sodium. How many of your liters and how many of your friend's liters should you mix to make 30 liters of 15% sodium?

5.3 Enrichment and Extension

Proving Systems of Equations

In Exercises 1–10, use the graph.



1. Find the coordinates of point p .
2. Find the equation in slope-intercept form of line m and line l .
3. Verify that point p lies on both lines by substituting its coordinates into both equations.
4. Write the standard form of both lines.
5. Solve the system of equations by substitution.
6. Solve the system of equations by elimination.
7. What does point p do for both equations?
8. Shade below line m , and above line l .
9. Write the inequalities.
10. State a point on the graph that solves both inequalities.

5.3 Puzzle Time

What Did The Bowling Pins Say To The Bowling Ball?

Write the letter of each answer in the box containing the exercise number.

Solve the system of linear equations by elimination.

Check your solution.

1. $x + 7y = -5$

$-x + y = -3$

2. $6x + y = 25$

$9x - y = 20$

3. $8x + \frac{1}{2}y = 32$

$-x - \frac{1}{2}y = -4$

4. $11x - 6y = -19$

$-11x + 5y = 14$

5. $x + y = 1$

$3x - 4y = -4$

6. $\frac{1}{3}x + y = 6$

$-x - 2y = -9$

7. $5x - 2y = 9$

$2x - 5y = -9$

8. $-2x - 3y = 5$

$-3x - 4y = 9$

9. $7x + 2y = -12$

$3x + 4y = -24$

10. $6x + 5y = 10$

$-2x - 3y = -14$

11. $8x - 9y = -2$

$-3x + 13y = 20$

12. $-12x - 5y = -22$

$8x + 3y = 13$

13. On one reading list, there were a total of 12 fiction and nonfiction books. On the second reading list, there were 2 times as many fiction books and 3 times as many nonfiction books, making a total of 28 books on the second reading list. Solve a system of linear equations to find the number of fiction and nonfiction books on the first reading list.

Answers

A. (4, 0)

R. (-9, 9)

P. $(-\frac{1}{4}, 5)$

S. (3, 7)

E. (2, 2)

S. (-5, 8)

U. (0, 1)

E. (2, -1)

L. (3, 3)

S. (0, -6)

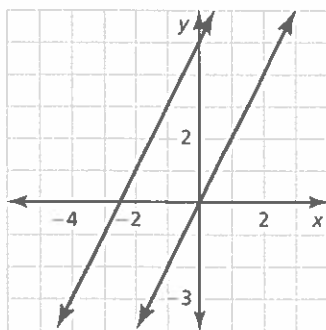
E. (1, 5)

P. (8, 4)

A. (-7, 3)

13	7	11	3	9	4		10	12	8	6	1		5	2
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5.4 Start Thinking



Find an equation for each line. Is there anything special about the comparison of each line's slope? Is there a point of intersection? If so, what is it? How can you tell when a system of equations will intersect at one point? How can you tell when a system will not intersect?

5.4 Warm Up

Solve the equation for y , so it is in slope-intercept form.

1. $x + y = 4$

2. $-2x + y = 10$

3. $-3x + y = 12$

4. $2x - 5y = -1$

5. $6x - y = 11$

6. $-\frac{2}{5}x + y = -2$

5.4 Cumulative Review Warm Up

Describe the transformation from the graph of f to the graph of g .

1. $f(x) = -\frac{1}{5}x - 2$; $g(x) = f(x) + 4$

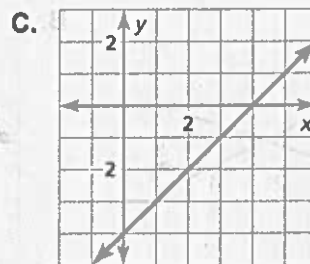
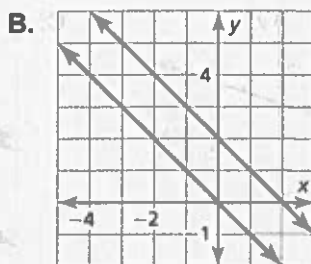
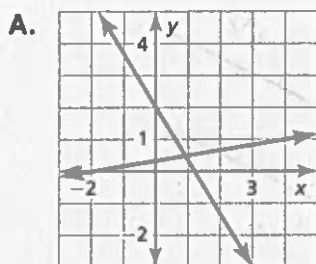
2. $f(x) = -4x - 5$; $g(x) = f(x) - 1$

3. $f(x) = x + 1$; $g(x) = f(x - 6)$

5.4 Practice A

In Exercises 1–3, match the system of linear equations with its graph. Then determine whether the system has *one solution*, *no solution*, or *infinitely many solutions*.

1. $x + y = 0$
 $3x + 3y = 6$
2. $5x + 3y = 6$
 $x - 6y = -2$
3. $-2x + 2y = -8$
 $x - y = 4$



In Exercises 4–6, solve the system of linear equations.

4. $y = 5x + 1$
 $y = 5x - 1$
5. $y = 3x + 7$
 $y = -3x + 7$
6. $-x - 4y = 10$
 $x + 4y = -10$

In Exercises 7–9, use only the slopes and y-intercepts of the graphs of the equations to determine whether the system of linear equations has *one solution*, *no solution*, or *infinitely many solutions*. Explain.

7. $y = 2x - 5$
 $4x - 2y = 10$
8. $y = -5x + 3$
 $15x + 3y = -3$
9. $-x + 2y = 4$
 $2x + y = 3$

10. Describe and correct the error in solving the system of linear equations.

✗

$$\begin{aligned} y &= -2x + 5 \\ 2x + y &= 5 \end{aligned}$$

The lines have different slopes.
So, the system has one solution.

11. You downloaded 2 DVDs and 10 songs for \$18. Your friend downloaded 3 DVDs and 15 songs for \$27. Write a system of linear equations that represents this situation. Can you determine the price of each DVD and each song? Explain.

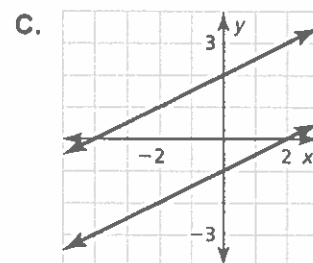
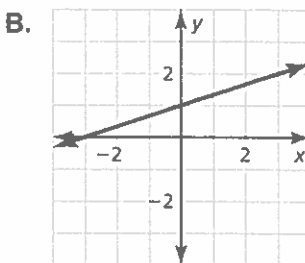
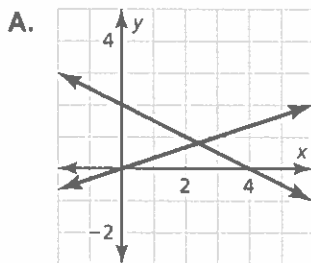
5.4 Practice B

In Exercises 1–3, match the system of linear equations with its graph. Then determine whether the system has *one solution*, *no solution*, or *infinitely many solutions*.

1. $x - 3y = -3$
 $-4x + 12y = 12$

2. $x - 3y = 0$
 $x + 2y = 4$

3. $x - 2y = -4$
 $3x - 6y = 6$



In Exercises 4–9, solve the system of linear equations.

4. $3x - 3y = 6$
 $-6x + 6y = -12$

5. $12x - 8y = 10$
 $-6x + 4y = 5$

6. $4x - 3y = 16$
 $x + y = -3$

7. $6x + 9y = -15$
 $4x + 6y = 10$

8. $-x - 4y = 10$
 $x + 4y = 10$

9. $-5x + 2y = 3$
 $10x - 4y = -6$

In Exercises 10–15, use only the slopes and *y*-intercepts of the graphs of the equations to determine whether the system of linear equations has *one solution*, *no solution*, or *infinitely many solutions*. Explain.

10. $x - 3y = 9$
 $2x - 3y = 9$

11. $-3x + 8y = 32$
 $6x - 16y = -64$

12. $2x + 2y = 2$
 $9x + 9y = 9$

13. $2x - 4y = -24$
 $3x - 6y = -24$

14. $y = -3x + 7$
 $3x + 2y = -6$

15. $5x + y = -3$
 $2y = -10x - 6$

16. Write a system of three linear equations in two variables so that two of the equations have infinitely many solutions, but the entire system has one solution.

17. Consider the system of linear equations $y = ax + 3$ and $y = \frac{1}{a}x - 2$.

- If possible, find a value of a so that the system of linear equations has no solution.
- If possible, find a value of a so that the system of linear equations has one solution.

5.4 Enrichment and Extension



Different Interpretations

A jar of candy is on the counter. Except for 16 pieces, all are red. Except for 16 pieces, all are blue. Except for 16 pieces, all are green. Except for 18 pieces, all are yellow. How many pieces of each color are there? How many pieces of candy are there in all?

1. Write a system of equations for the situation.
2. Justify your equations.
3. Solve the systems the way you see fit.
4. Explain your steps.
5. Compare your work with others. Did your classmates have the same interpretation of the problem? Is there more than one way to solve the system?
6. Find a different way to solve the same problem.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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 5.4 Puzzle Time**What Has Four Legs But Can't Walk?**

Write the letter of each answer in the box containing the exercise number.

Solve the system of linear equations.

1. $y = 3x + 8$

$y = -3x + 8$

C. infinitely many solutions D. no solution E. (0, 8) F. (16, 8)

2. $4x - 5y = 9$

$-8x + 10y = -18$

A. infinitely many solutions B. no solution C. (-27, 0) D. (0, 9)

3. $5x - 5y = 10$

$7x - 14y = -28$

I. infinitely many solutions J. no solution K. (-4, 6) L. (8, 6)

4. $-28x + 14y = 42$

$2x - y = 3$

S. infinitely many solutions T. no solution U. (3, 3) V. (1, 2)

5. $y = 6x - 17$

$-12x + 2y = -34$

A. infinitely many solutions B. no solution C. (17, 0) D. (0, -17)

6. $-4x + 4y = 13$

$3x - 3y = -19$

A. infinitely many solutions B. no solution C. (0, 13) D. (19, 0)

5		4	2	6	3	1
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5.5 Start Thinking

One of the most common uses for solving systems of equations is in business. When the amount of money spent on expenses equals the amount of money gained in revenue, it is called “breaking even.”

Suppose you are in charge of a company that rents moving vans to customers. Each van costs \$18,000, and you spend an average of \$35 per rental day on maintenance costs. You rent the van for \$59.99 per day. How could you set up a system of equations to find where your company “breaks even?” On average, how many days must one van be rented before the company makes any profit?

5.5 Warm Up

Graph the equation in a coordinate plane.

1. $y = 4x$

2. $y = \frac{4}{3}x - 2$

3. $x + y = 5$

4. $y = 3$

5. $2x + 5y = 11$

6. $y = -2x - 2$

5.5 Cumulative Review Warm Up

Write the next three terms of the arithmetic sequence.

1. First term: 3

Common difference: 12

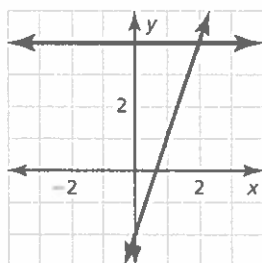
2. First term: 19

Common difference: -7

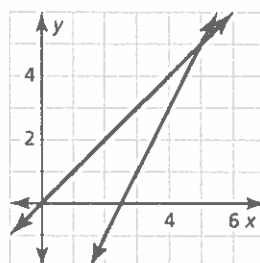
5.5 Practice A

In Exercises 1 and 2, use the graph to solve the equation. Check your solution.

1. $3x - 2 = 4$



2. $x = 2x - 5$



In Exercises 3–6, solve the equation by graphing. Check your solution.

3. $x - 6 = 3x$

4. $-x = x - 4$

5. $x - 4 = -2x + 2$

6. $\frac{1}{3}x + 1 = x - 3$

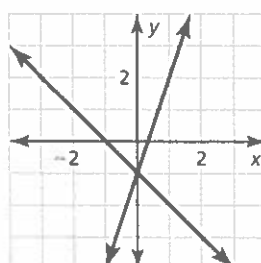
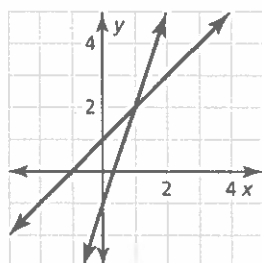
In Exercises 7 and 8, solve the equation by graphing. Determine whether the equation has *one solution*, *no solution*, or *infinitely many solutions*.

7. $4x + 3 = 4x - 2$

8. $3x + 6 = 3(x + 2)$

9. Use the graphs to solve the equation. Check your solutions.

$|3x - 1| = |x + 1|$



In Exercises 10 and 11, solve the equation by graphing. Check your solutions.

10. $|x + 6| = |-2x|$

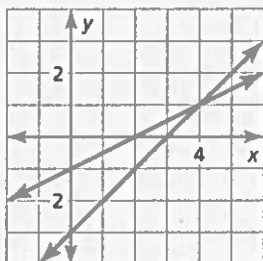
11. $|x + 1| = |2x - 4|$

12. You need to rent a bowling lane. On Friday nights, you have two options. Option A is a \$20 lane rental plus \$3 per game. Option B is a \$35 lane rental with a maximum of 10 games. For what number of games is the total cost the same for each option?

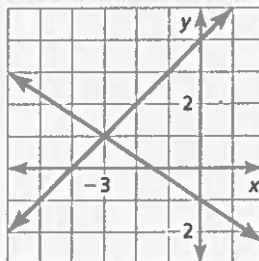
5.5 Practice B

In Exercises 1 and 2, use the graph to solve the equation. Check your solution.

1. $x - 3 = \frac{1}{2}x - 1$



2. $-\frac{2}{3}x - 1 = x + 4$



In Exercises 3–6, solve the equation by graphing. Check your solution.

3. $-3x + 5 = x + 1$

4. $\frac{1}{4}x - 6 = -2x + 3$

5. $3x + 6 = 3(x + 2)$

6. $-5(x + 2) = 4x - 1$

In Exercises 7 and 8, solve the equation by graphing. Determine whether the equation has *one solution*, *no solution*, or *infinitely many solutions*.

7. $-2(-x - 1) = 2x + 2$

8. $\frac{1}{4}(12x - 10) = 3x + 2$

In Exercises 9 and 10, solve the equation by graphing. Check your solutions.

9. $|x + 2| = |5 - x|$

10. $3|x - 1| = |2x + 8|$

In Exercises 11 and 12, use a graphing calculator to solve the equation.

11. $0.6x - 1.1 = 0.5x - 0.4$

12. $1.3x + 0.8 = 2.5x - 0.4$

13. Determine one set of values of a and b of the equation $2x - 3 = ax + b$ in each situation.

- a. The equation has no solution.
- b. The equation has infinitely many solutions.
- c. $x = 4$ is a solution.

14. You need to hire a taxi. Taxi A charges \$9.25 plus \$1.50 per mile. Taxi B charges \$10.50 plus \$1.25 per mile. Use a graphing calculator to find the number of miles for which the total costs are the same for each taxi.

5.5 Enrichment and Extension**Extending Solving Equations by Graphing**

In Exercises 1–6, graph and solve the equation by making a system of equations. Then prove that the system works algebraically. Check your solution.

1. $|x| = -\frac{1}{2}x + 3$

2. $|x| = x + 4$

3. $-|x| + 4 = \frac{1}{3}x + 2$

4. $|x| = x$

5. $|x| = -x$

6. $x^2 = 3x$

5.5 Puzzle Time

Why Don't Centipedes Play Soccer?

A	B	C	D	E	F
G	H	I	J	K	L

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

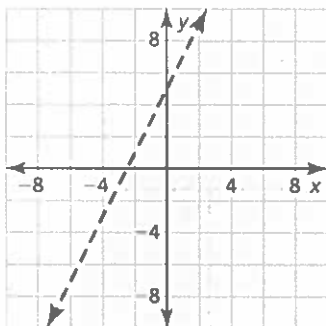
infinitely many solutions
GET
2, 4
GAME
7
WIN
0, 2
HAS
no solution
THE
-12, 4
ON
$\frac{1}{4}$
LEGS
$\frac{1}{9}$
GOAL
-6
THEIR

Solve the equation by graphing. Check your solution.

- A. $2x = -x - 6$
- B. $4x - 5 = 4x + 1$
- C. $3x + 7 = -13 - 2x$
- D. $\frac{1}{2}x - 9 = 13 - 5x$
- E. $-2(6 - x) = 2x - 12$
- F. $-\frac{1}{5}(5x - 10) = x + 14$
- G. $|x| = |x - 1|$
- H. $|x - 12| = |2x|$
- I. $|4x| = |x + 15|$
- J. $|3x - 8| = |x|$
- K. $|x - 3| = |2x - 3|$
- L. $|x - 6| = 3|x|$

-4
TIME
$\frac{1}{2}$
SHOES
6
NET
$-3, \frac{3}{2}$
ENDED
-3, 5
THE
4
THEY
1
BALL
-2
BY
11
SOCKS

5.6 Start Thinking



Is the point $(2, 9)$ on the dashed line? Find an equation of the line represented by the dashed line, replacing the equal sign with a “less than” symbol. Does the point $(2, 9)$ satisfy the inequality?

5.6 Warm Up

Tell whether the value is a solution of the inequality.

- $4x > 11$; $x = 3$
- $16 \geq 4y$; $y = 4$
- $17x \geq 15$; $x = 0$
- $-7x < 9$; $x = 6$
- $-7b < 25$; $b = -4$
- $x + \frac{2}{9} > 0$; $x = -1$

5.6 Cumulative Review Warm Up

Solve the literal equation for x .

- $y = 3x - 9x$
- $a = x - 7xz$
- $y = 3x - rx - 7$
- $sx - tx = r$
- $11 + 6x + 3kx = y$
- $C = 86x - 59$

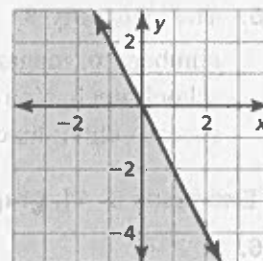
5.6 Practice A

In Exercises 1–4, tell whether the ordered pair is a solution of the inequality.

1. $x - y > 2$; (5, 4)
2. $x + y \leq -3$; (-1, -4)
3. $5x + y \leq 12$; (2, 2)
4. $x - 3y > 6$; (3, -1)

In Exercises 5–10, tell whether the ordered pair is a solution of the inequality whose graph is shown.

5. (1, 0)
6. (-1, -1)
7. (0, 0)
8. (-3, 1)
9. (2, -4)
10. (0, 3)

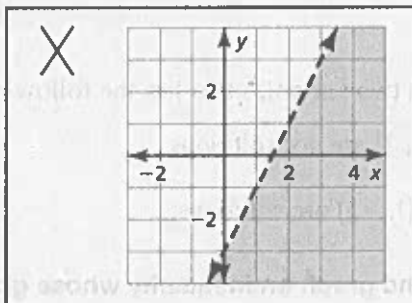


11. You have \$150 to spend on video games. The inequality $7x + 32y \leq 150$ represents the number x of used video games and the number y of new video games that you can purchase. Can you purchase 10 used video games and 3 new video games? Explain.

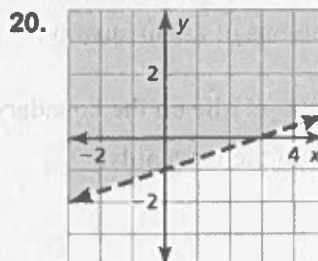
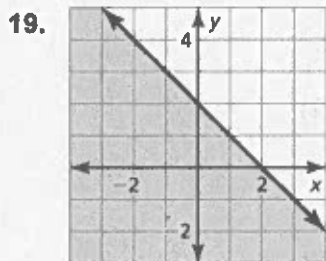
In Exercises 12–17, graph the inequality in a coordinate plane.

12. $y \geq 2$
13. $x < -3$
14. $-y < -1$
15. $y < 2x - 5$
16. $y \geq -x + 3$
17. $-3x + y \leq 1$

18. Describe and correct the error in graphing $y > 2x - 3$.



In Exercises 19 and 20, write an inequality that represents the graph.



5.6 Practice B

In Exercises 1–4, tell whether the ordered pair is a solution of the inequality.

1. $5x + 7y \leq 10$; $(-1, 2)$

2. $4x - y > 2$; $(-2, -2)$

3. $-3x - 2y \geq 0$; $(3, -3)$

4. $-8x - y < 4$; $(0, 2)$

5. The inequality $9x + 5y \geq 60$ represents the number x of newspapers and the number y of magazines you must sell to earn enough points to earn a special school lunch. You sell four newspapers and six magazines. Do you receive a special school lunch? Explain.

In Exercises 6–11, graph the inequality in a coordinate plane.

6. $x \geq 4$

7. $y < -6$

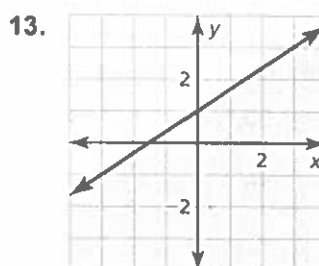
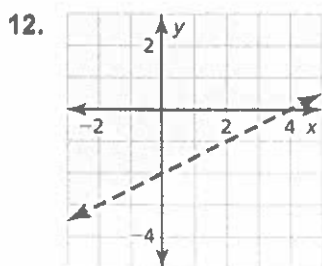
8. $x < 0$

9. $y < 2x + 2$

10. $-3x + y \leq -2$

11. $x - 2y \geq 6$

In Exercises 12 and 13, write an inequality that represents the graph.



14. Write a linear inequality in two variables that has the following two properties.
- $(2, -1)$, $(2, 3)$, and $(3, 1)$ are not solutions.
 - $(0, -3)$, $(-2, 1)$, and $(1, -5)$ are solutions.

In Exercises 15 and 16, write and graph an inequality whose graph is described by the given information.

15. The points $(4, 10)$ and $(-2, -8)$ lie on the boundary line. The points $(1, -3)$ and $(-1, -7)$ are *not* solutions of the inequality.
16. The points $(-3, 7)$ and $(9, -5)$ lie on the boundary line. The points $(-4, 2)$ and $(6, -5)$ are solutions of the inequality.

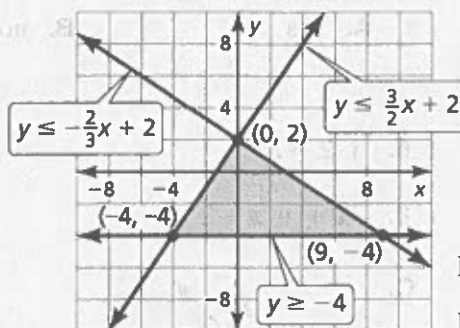
5.6 Enrichment and Extension

Linear Programming

Linear Programming is a modeling technique that is useful for guiding quantitative decisions in engineering, business, and the sciences. In order to solve a linear programming problem, you must find the maximum and minimum values of a linear equation within a set of constraints expressed as inequalities. This is called the *feasible region*, or the solution set to a system of linear inequalities. The extreme values, or maximum and minimum values, of any objective function $f(x, y)$ must occur at the vertices of the feasible region.

Example: Evaluate the function f at the vertices of the feasible region in order to obtain the maximum and minimum values. At which vertex does f attain its minimum value? At which vertex does f attain its maximum value?

$$\begin{aligned} 2x + 3y &\leq 6 \\ 3x - 2y &\geq -4 \\ y &\geq -4 \\ f(x, y) &= x + 3y \end{aligned}$$



(x, y)	$x + 3y$	$f(x, y)$
$(0, 2)$	$(0) + 3(2)$	6
$(-4, -4)$	$(-4) + 3(-4)$	-16
$(9, -4)$	$(9) + 3(-4)$	-3

Maximum: 6 at $(0, 2)$

Minimum: -16 at $(-4, -4)$

In Exercises 1–4, evaluate the function f at the vertices of the feasible region in order to obtain the maximum and minimum values. At which vertex does f attain its minimum value? At which vertex does f attain its maximum value?

- $x + y \geq 2$
 $2y \geq 3x - 6$
 $4y \leq x + 8$
 $f(x, y) = 3y + x$
- $x + y \geq 4$
 $3x - 2y \leq 12$
 $x - 4y \geq -16$
 $f(x, y) = x - 2y$
- $2 \leq x \leq 6$
 $x + y \leq 7$
 $-3x - 2y \leq -4$
 $f(x, y) = -x + 3y$
- $x \geq 0$
 $y \geq 0$
 $x + 2y \leq 6$
 $2y - x \leq 2$
 $f(x, y) = 3x - 5y$

- The vertices of a feasible region are $A(1, 3)$, $B(5, 3)$, and $C(1, 4)$. Write a function that satisfies each condition.
 - A is the maximum and B is the minimum.
 - C is the maximum and B is the minimum.
 - B is the maximum and A is the minimum.
 - A is the maximum and C is the minimum.
 - A and C are both the maxima and B is the minimum.

5.6 Puzzle Time

What Kind Of Television Show Is Relaxing To Watch?

Write the letter of each answer in the box containing the exercise number.

Tell whether the ordered pair is a solution of the inequality.

1. $9x - 7y \geq 6$; $(1, -2)$

A. yes

B. no

2. $4x + 3y < -3$; $(6, -9)$

L. yes

M. no

3. $8x - 2y < -1$; $(-3, -12)$

H. yes

I. no

4. $x - 10y \leq 13$; $(8, -\frac{1}{2})$

A. yes

B. no

Match the inequality with its graph.

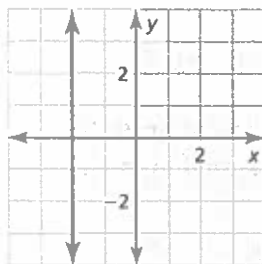
5. $y \geq 2$

6. $x \geq -2$

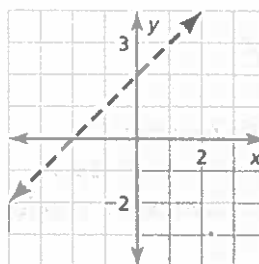
7. $y < x + 2$

8. $3x + y > -2$

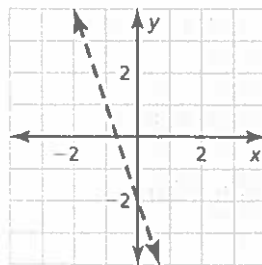
L.



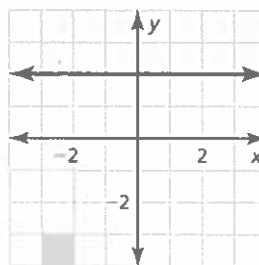
C.



S.



T.



4		8	3	5		7	1	6	2
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5.7 Start Thinking

Graph the linear inequalities $y < -x + 4$ and $y > 3x - 9$ on the same coordinate plane. What does the area shaded for both inequalities represent? What does the area shaded for just one of the inequalities represent? Is there any area that is not shaded for either inequality? If so, what does that area represent?

Choose an ordered pair that is in the area shaded for both inequalities and plug the values into the inequalities. What happens? Choose an ordered pair that is in the area not shaded for either inequality and plug the values into the inequalities. What happens?

5.7 Warm Up

Graph the inequality.

1. $y \geq -1$

2. $4x - 5y < 3$

3. $7x - 4y \geq -9$

4. $-5x - 6y > 14$

5. $\frac{x}{5} - y < 2$

6. $y \geq 2$

5.7 Cumulative Review Warm Up

Solve the inequality.

1. $2y + 8 \leq 16$

2. $10 - q \geq 14$

3. $4p \leq 16$

4. $10(2g + 3) \geq 10 \cdot 3g$

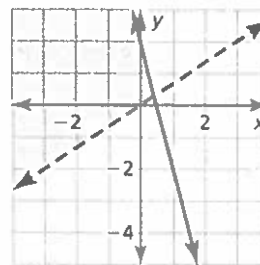
5. $7(x + 6) \leq 2(5x)$

6. $z + (-8) > 6$

5.7 Practice A

In Exercises 1–4, tell whether the ordered pair is a solution of the system of linear inequalities.

1. $(2, 1)$
2. $(-3, -2)$
3. $(0, 2)$
4. $(-1, -4)$



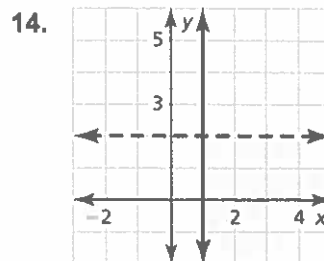
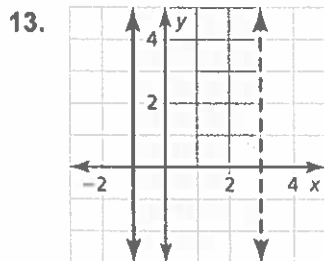
In Exercises 5 and 6, tell whether the ordered pair is a solution of the system of linear inequalities.

5. $(2, -1)$; $y \geq 3$
 $y < x + 1$
6. $(7, -4)$; $y < 0$
 $y < x - 3$

In Exercises 7–12, graph the system of linear inequalities.

7. $y > 2$
 $x < -3$
8. $y \geq 1$
 $y < 4$
9. $y \geq -2x$
 $y > 1$
10. $y \leq x + 2$
 $y > x - 2$
11. $y < 2x$
 $y < x + 1$
12. $3x + y \leq 0$
 $-2x + y > -1$

In Exercises 13 and 14, write a system of linear inequalities represented by the graph.



15. You can spend at most \$60 on beads. A bag containing red beads costs \$2 per bag. A bag containing blue beads costs \$3 per bag. You need more bags of blue beads than bags of red beads.
 - a. Write and graph a system of linear inequalities that represents the situation.
 - b. Identify and interpret a solution of the system.
 - c. Use the graph to determine whether you can buy 9 bags of red beads and 12 bags of blue beads.

5.7 Practice B

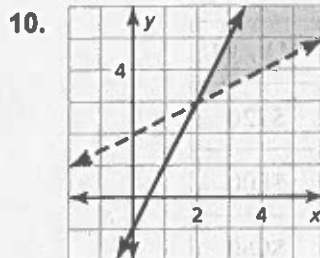
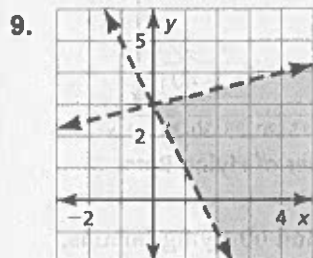
In Exercises 1 and 2, tell whether the ordered pair is a solution of the system of linear inequalities.

1. $(2, 0)$; $y > x - 5$
 $y \leq 2x + 1$
2. $(1, 4)$; $y < 2x + 2$
 $y \geq -3x + 4$

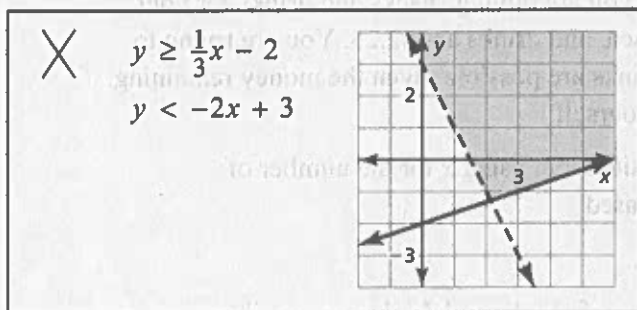
In Exercises 3–8, graph the system of linear inequalities.

3. $x + y \leq 2$
 $y \leq 1$
4. $3x + y > 4$
 $y < -3x + 1$
5. $x - y < 3$
 $-x - y \geq -1$
6. $y \leq \frac{1}{3}x + 2$
 $y > -\frac{1}{2}x + 5$
7. $x > -2$
 $y < 3$
 $y \geq 2x - 1$
8. $x + y > 4$
 $x - y < -1$
 $y > 7$

In Exercises 9 and 10, write a system of linear inequalities represented by the graph.



11. Describe and correct the error in graphing the system of inequalities.



12. The points $(1, 2)$, $(5, 5)$, $(1, 6)$ are the vertices of a shaded triangle.

- a. Write a system of linear inequalities represented by the shaded triangle.
- b. Find the area of the triangle.

5.7 Enrichment and Extension

Using Linear Programming

Example: A toy manufacturer wants to minimize the cost to produce two lines of toy airplanes. Because of the supply of materials, no more than 40 flying bats can be built each day, and no more than 60 flying falcons can be built each day. There are enough workers to build at least 70 toy airplanes each day. It costs \$12 to build a flying bat and \$8 to build a flying falcon. How many flying bats and falcons should be produced to minimize the cost, while still making production on both toys? What is the minimum possible cost each day?

Let x represent the number of flying bats.

Let y represent the number of flying falcons.

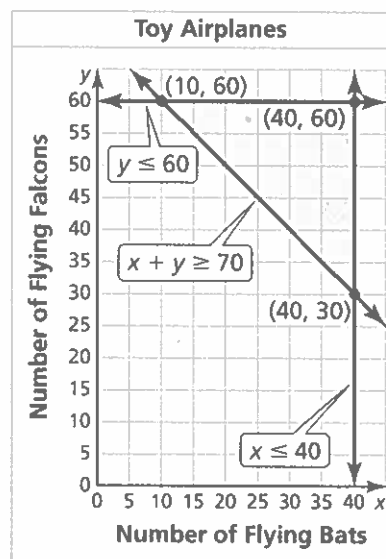
$$0 \leq x \leq 40$$

$$0 \leq y \leq 60$$

$$x + y \geq 70$$

$$f(x, y) = 12x + 8y$$

(x, y)	$12x + 8y$	$f(x, y)$
$(40, 30)$	$12(40) + 8(30)$	\$720
$(10, 60)$	$12(10) + 8(60)$	\$600
$(40, 60)$	$12(40) + 8(60)$	\$960



10 flying bats and 60 flying falcons;
Minimum Cost: \$600

1. You are treating two of your friends to the movies tonight. Your parent gives you \$70. Tickets are \$7 each. At the candy counter, you are buying snacks and drinks for your friends as they find seats. Snacks are \$2 each, and drinks are \$2.25. You are trying to decide what combination of snacks and drinks are possible given the money remaining. You can only carry 4 drinks on a tray by yourself.
 - a. Write a system of inequalities for this situation, using x for the number of snacks and y for bottles of water purchased.
 - b. Graph the system and find the vertices.
 - c. Indicate on the graph what combinations of snacks and drinks are possible. Explain your reasoning in-depth.
 - d. Does every point within the feasible region represent a valid solution in this context? Why or why not?
 - e. Denote one combination that is possible and one that is not. Explain your reasoning.
 - f. Prove each of your answers to part (e) algebraically.

5.7 Puzzle Time

What Do You Call The Tending Of Rabbits?

Write the letter of each answer in the box containing the exercise number.

Tell whether the ordered pair is a solution of the system of linear inequalities.

1. $(-7, 6); y > 5$

$y \leq -x + 4$

E. yes

F. no

2. $(8, -8); y < 9$

$y > -2x + 8$

Q. yes

R. no

3. $(9, -10); y \leq -x + 9$

$y \geq -2x + 12$

D. yes

E. no

4. $(-4, -4); y > 3x + 5$

$y \leq \frac{1}{2}x + 6$

A. yes

B. no

Match the system of inequalities with its graph.

5. $y < 5$

$y \geq x - 1$

6. $y > -3$

$x \leq 2$

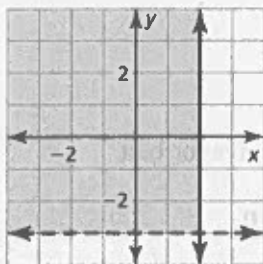
7. $y \geq x - 2$

$y \leq x + 2$

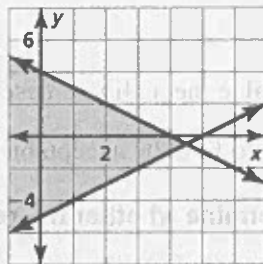
8. $x + y \leq 4$

$x - y \leq 5$

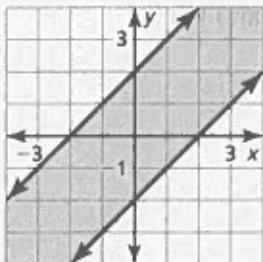
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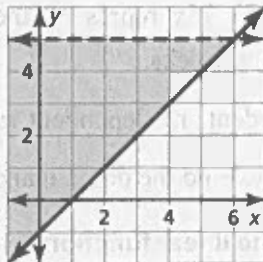
H.



C.



A.



8	5	6	3		7	4	2	1
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**Chapter
5****Cumulative Review**

In Exercises 1–3, solve the equation and check your answer.

1. $1 - 3x = -17$

2. $11\pi + 2x = 19\pi$

3. $10(x - 1) = -2x + 62$

4. A furnace repair person charges an initial fee of \$80 plus \$30 per hour to do repairs.

a. After how many hours would the cost of the repair be at least \$320?

b. How many hours did the repair person work if the total bill was \$230?

In Exercises 5–7, solve the equation. Graph the solution(s), if possible.

5. $|3x + 9| = 18$

6. $2|7y - 8| = -28$

7. $\frac{|4z + 8|}{-3} = -4$

In Exercises 8–10, solve the inequality. Graph the solution.

8. $2 - 3x \geq -x + 8$

9. $4t - 7 \geq 25$

10. $6x - x + 10 < 9 - 4$

In Exercises 11–13, solve the inequality. Graph the solution, if possible.

11. $|14x + 7| < 35$

12. $|7w - 2| + 8 \leq -9$

13. $-2|4 + 2x| < -20$

14. The ideal width of a certain conveyor belt for a manufacturing plant is 50 inches.

The width of an actual conveyor belt can vary from the ideal width by at most

$\frac{7}{32}$ of an inch.

a. Write an absolute value inequality to describe this situation.

b. Solve the inequality to find the acceptable widths, in inches, for this conveyor belt.

In Exercises 15 and 16, determine whether the relation is a function. Explain.

15. $(-3, 2), (0, 3), (3, 4), (6, 5), (-3, 6)$

16. $(3, 1), (-5, 1), (-3, -1), (-5, -1), (3, -1)$

17. The equation $y = 1725 - 75x$ represents the amount of money y (in dollars) left in your lunch account after x weeks.

a. Identify the independent and dependent variables.

b. Twenty weeks go by. Find the domain and range of the function.

In Exercises 18–20, graph the linear function.

18. $f(x) = -x - 1$

19. $w(x) = \frac{5}{3}x$

20. $h(x) = -4 - \frac{1}{5}x$

Chapter 5

Cumulative Review (continued)

21. The function $f(x) = 150 + 35x$ represents the amount of money a hotel charges (in dollars) for x nights, including a \$150 charge for parking.

- What is the total bill for four nights at the hotel?
- How many nights must you stay to have a bill of \$430?

In Exercises 22–24, find the x - and y -intercepts of the graph of the linear equation.

Use the intercepts to graph the linear equations. Label the intercepts.

22. $4x + 8y = 8$

23. $21x + 7y = 28$

24. $-3x + 5y = 10$

In Exercises 25–27, find the slope and y -intercept of the graph. Graph the linear equation.

25. $y = 2x$

26. $y = -6$

27. $4x - 5y = 25$

In Exercises 28–30, compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

28. $t(x) = 2|x| + 5$

29. $r(x) = |x - 1|$

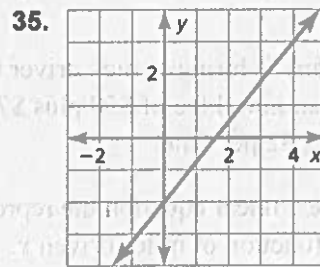
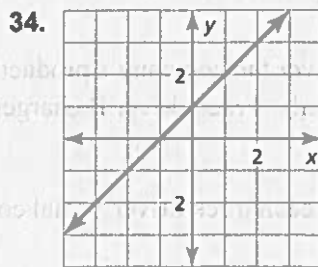
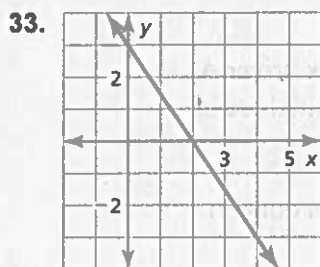
30. $h(x) = -\frac{1}{2}|x - 1|$

In Exercises 31 and 32, write an equation of the line with the given slope and y -intercept.

31. slope: $-\frac{7}{3}$ and y -intercept: 0

32. slope: 0 and y -intercept: -10

In Exercises 33–35, write an equation of the line in slope-intercept form.



In Exercises 36–39, write an equation in point-slope form of the line that passes through the given points.

36. $(1, 2), (3, 4)$

37. $(-8, -9), (-6, -5)$

38. $(2, -7), (-7, 2)$

39. $(0, 2), (10, -3)$

**Chapter
5****Cumulative Review** (continued)

In Exercises 40–42, write an equation of the line that passes through the given point and is parallel to the given line.

40. $(1, 5); y = -x + 4$

41. $(-3, -7); y = \frac{7}{2}x - 9$

42. $(0, -6); 4x + 2y = 10$

In Exercises 43 and 44, tell whether x and y show a *positive*, a *negative*, or *no correlation*.

43.

x	-4	-3	-2	0	2	4	5
y	-4	5	2	-1	-2	4	-4

44.

x	-2	-1	-1	0	1	2	2
y	2	3	1	0	-3	0	-2

In Exercises 45–47, determine whether the sequence is arithmetic. If so, find the common difference.

45. $-7, -4, -1, 1, \dots$

46. $-13, -17, -21, -25, \dots$

47. $10, 4, -2, -8, \dots$

In Exercises 48 and 49, graph the function. Describe the domain and range.

48. $y = \begin{cases} \frac{3}{2}x + 7, & \text{if } x < -2 \\ -\frac{5}{2}x - 4, & \text{if } x \geq -2 \end{cases}$

49. $y = \begin{cases} -3, & \text{if } x < -1 \\ 4x + 2, & \text{if } x > -1 \end{cases}$

In Exercises 50–52, solve the system of linear equations by graphing.

50. $y = -\frac{5}{3}x + 3$

51. $y = 4$

52. $x - 3y = 9$

$y = \frac{1}{3}x - 3$

$y = -\frac{5}{2}x + 4$

$2x + 2y = 2$

53. A company is hiring a truck driver to deliver the company's product. Truck driver A charges an initial fee of \$50 plus \$7 per mile. Truck driver B charges an initial fee of \$175 plus \$2 per mile.

- Write a linear equation that represents each truck driver's total cost y (in dollars) as a function of miles driven x .
- Solve the system of linear equations by graphing. Interpret your solution.

In Exercises 54–56, solve the system of linear equations by substitution. Check your solution.

54. $y = 6x - 11$

55. $2x + y = 20$

56. $5x - 2y = 18$

$-2x - 3y = -7$

$6x - 5y = 12$

$-2x - y = -9$

57. You spend \$27 on seven bags of candy to throw while you participate in a parade. The bags cost either \$5 or \$3. How many bags of each amount did you purchase?

**Chapter
5****Cumulative Review (continued)**

In Exercises 58–60, solve the system of linear equations by elimination. Check your solution.

58. $-4x - 2y = -12$

$4x + 8y = -24$

59. $-3x + 7y = -16$

$-9x + 5y = 16$

60. $5x + 4y = -30$

$3x - 9y = -18$

61. School A and school B have taken a field trip to a professional baseball game. School A took 8 vans and 8 buses to get its 240 students to the game. School B took 4 vans and 1 bus to get its 54 students to the game. Find the number of students that were in each van and bus.

In Exercises 62–64, use only the slopes and y -intercepts of the graphs of the equations to determine whether the system of linear equations has *one solution*, *no solution*, or *infinitely many solutions*. Explain.

62. $y = -\frac{1}{4}x + 5$

$2x + 8y = 40$

63. $6x + 3y = 6$

$6x + 3y = -6$

64. $x - y = 11$

$2x + y = 19$

In Exercises 65–68, solve the equation by graphing. Check your solution(s).

65. $4x + 1 = -2x + 7$

66. $3x - 4 = 5(x + 2)$

67. $|x - 2| = |3x + 6|$

68. $|x + 4| = |2x - 1|$

In Exercises 69–71, graph the inequality in a coordinate plane.

69. $y > 2x - 1$

70. $y \leq \frac{2}{3}x + 1$

71. $14x - 7y < -21$

72. Your work truck can haul at most 1000 pounds. The inequality $10x + 50y \leq 1000$ represents the number x of bags of potting soil and the number y of bags of mulch your truck can haul. Can you haul 20 bags of potting soil and 20 bags of mulch? Explain.

In Exercises 73–75, graph the system of linear inequalities.

73. $4x + y < 2$

$y > -2$

74. $y \geq \frac{2}{3}x + 3$

$y > -\frac{4}{3}x - 3$

75. $2x - 3y \geq 6$

$-3x + 2y < 6$

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